Public Comments on Whole Body Contact Recreation Use

and Department Recommendation for Use Designation

WBID 1707 Missouri River, Part 2

Missouri Department of Natural Resources
Water Protection Program

Heisel, Edward

Cp7867

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Mississippi River, MO

Disclaimer

Chain of Rocks section off of Riverview Drive in north St. Louis

Class III-IV

1 Miles

Gauge Information

MO	Mississippi River at St. Louis	-0.34 ft	81500 cfs	usgs	9/12 8:00

Min Sug. Level: -3 ft
Max Sug. Level: 10 ft

Description:

River Description

Lat/longitude coords are guesswork, in order to give a rough idea of where the fun is.

Photos/Video (Thumbnail Index)

Michael Gordon in Rookies	152.74KB	.
Cobblestone	151.67KB	.jpg
Primo at near it's best level	147.39KB	.jpg
Salmon Run (Oil Can Hole)	149.41KB	.jpg
Cobblestone at 6 feet	15.52KB	.JPG

StreamKeeper: John Tansil **Status:** unverified **Last Updated:** 2005-06-21 09:52:42

StreamKeeper Project - Find out more about the StreamKeeper Project, where this data comes from, how it is maintained, and how you can become a StreamKeeper.

User Comments

Herm Smith 2005-09-07 10:41:22

The rivers listing for

http://www.americanwhitewater.org/rivers/id/2950/

Is out of date since 9/11/01 and the drought of the past four years (now over) for the lower Missouri and Mississippi Rivers. A better description would
be:

Min Sug. Level: -3 ft
Max Sug. Level: 10 ft

The website for StreamTeach (http://streamteach.org/chain-of-rocks.html) has detailed descriptions and illustrative photos. Ranges from small waves and good play holes along the Missouri banks to big-water wave trains below the Illinois side water tower. Best park-and-

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Note: American Whitewater Members receive access to additional content, like weather forecasts, maps and GPS coordinates.

play holes and waves (Rookies, Cobblestone, Primo) abut the St. Louis City Water Treatment Plant. Since 9/11 the City enforces trespass prohibitions on its property but leaves play boaters alone who remain in their boats on the Mississippi. One easily avoidable low-water dam danger 100 yards off the water treatment bank is near a good play hole, Salmon Run, formed when the gauge is below nine feet. Typically the Chain is playable from mid-August through November. The StreamTeach message Board is a good place to pick up paddlers who play the river often and know play and danger spots.

Registered users can submit comments.

Mississippi River
Missouri River

Heisel, Edward "red D.

WQS / UAA: Comment re Mississippi and Missouri River - Stacia Bax/WPCP/DEQ/MODNR

"Edward Heisel"
<ejheisel@yahoo.com>
10/17/2005 10:34 AM

To "Bonnie Liscek" <liscek.bonnie@epa.gov>, "Stacia Bax" <stacia.bax@dnr.mo.gov>, "Phil Schroeder" <phil.schroeder@dnr.mo.gov>, "Marlene Kirchner"
cc "Edward Heisel" <ejheisel@yahoo.com>
bcc
Subject WQS / UAA: Comment re Mississippi and Missouri River

Bonnie, Stacia, Phil and Marlene - These are supplemental comments submitted on my own behalf regarding the uses of the Mississippi and Missouri rivers.

First, this past Saturday, October 15, 2005, I spent the day kayaking in the Mississippi River about a mile south of the Chain of Rocks. I put in at the boat ramp near the St. Louis water plant and paddled across the river near Mosenthein Island and adjacent sandbars. I also took a brief (the water was cold) swim in shallow water near one of the sandbars off Mosenthein Island.

The point of this letter is to relay that there are areas of the Mississippi (like the Missouri) that are perfectly suitable for human recreational uses. There are parts of the river that would pose some risk to swimmers (at the ends of dikes, etc.), but there are many other parts near the shore and near sandbars that have slow current, are relatively shallow, and have a sandy substrate suitable for wading or swimming. In this way, the Mississippi differs little from other rivers, such as the Meramec, that have long been recognized for their recreational potential and existing uses. Few people would swim in the swirling current of the Meramec near a submerged tree, but people can and do swim in other reaches of the stream.

The Mississippi should not be written off as a recreational stream because parts of it pose dangers to swimmers. While few people may attempt to swim in the main channel at places like downtown St. Louis, this does not mean that swimming is not an attainable and existing use in many other reaches of the river. Others have already pointed out to you that swimming and whitewater kayaking occur in the reach of the river north of downtown St. Louis. There has also been evidence submitted of water skiing in the river south of St. Louis. Water skiing is fairly common on the Missouri River, of which I am more familiar, a river that is similar in size and physical characterisitcs to the Mississippi. As long as some precautions are taken, there is little danger in water skiing in the open channel. In sum, my own uses of the river described above do not stand in isolation.

The Mississippi admittedly raises some technical and financial challenges in terms of designated uses, water quality criteria and effluent limitations. However, DNR and EPA should take a scientifically and legally rigorous approach to determining appropriate uses for this waterbody and not jump to conclusions because some policy-makers, who may have never explored the river, feel that only "crazy damn fools" use it for recreation. (Words of Clean Water Commission Chairman Thomas Herrmann on KWMU on September 8, 2005.) Based on my own observations and inquiries, there are many parts of the Mississippi that are physically suitable for human recreation and there are actually recreational uses occurring. Moreover, as was pointed out during the comment period, there is a multi-million dollar effort underway in St. Louis to create more parks and trails along the Mississippi, and it would be logical to assume that more

people will access the river as this project unfolds. It would be refreshing if state and federal agencies identified improved water quality in the Mississippi as an important challenge to be tackled in the coming years instead of automatically dismissing it as too difficult and locking us into the status quo.

The second thing I wanted to relay in this letter concerns the Missouri River. Over the Labor Day weekend this year, three friends and I kayaked from Hermann to St. Albans on the Missouri. I was amazed at the amount human activity on the river over that weekend, especially in the reach between New Haven and Washington. There were numerous people observed water skiing, on jet skis, and swimming. Additional evidence of swimming was seen near Labadie, and one of my colleagues took a swim at St. Albans. I took an accidental swim myself in the middle of the river near New Haven.

The Missouri remained on the whole body contact list in the final order of rulemaking approved by the Clean Water Commission in September. Nonetheless, I wanted to relay this information as further evidence to support such designation, and in the hope that it will inspire state and federal agencies to redouble efforts to improve water quality and restore natural characteristics to this magnificient river.

Ted Heisel
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Mississippi Rivers

MO WQS MS River Designation - Stacia Bax/WPCP/DEQ/MODNR

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E. p183

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11/16/2005 05:50 PM

To "Bonnie Liscek" <liscek.bonnie@epamail.epa.gov>, "Stacia Bax" <stacia.bax@dnr.mo.gov>
cc "Dan Sherburne" <dsherburne@moenviron.org>, "Edward Heisel" <ejheisel@yahoo.com>
bcc
Subject MO WQS MS River Designation

Stacia / Bonnie- Attached is an article for the record as to MS River uses. There may be more forthcoming. Thanks, Ted Heisel

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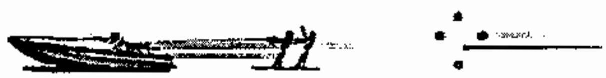

THE MISSISSIPPI CHALLENGE
June 26 - July 1, 2000

Two people. One Dream. Six Days. World Record

Day by Day Description of What Happened

Two Australian water-skiers with a ton of endurance, determination, and heart will take their place behind a boat in the Mississippi River on June 26 to face their goal of the Mississippi Challenge. The attempt is to set a world record by water-skiing the commercially navigable length of the Mississippi River, a distance of 1819 miles or 3032 km, starting in Boom Island, downtown Minneapolis, Minnesota, and ending in the Gulf of Mexico.

By making this trip, the two skiers and brothers, Brenton and Sean McGrath, will establish a world record and will raise money for the The Leukemia & Lymphoma Society and an Australian charity designed to provide housing for families whose children are going through cancer treatments. The Leukemia-Lymphoma Society was an obvious charity choice for the skiers since Brenton himself has leukemia.

Brenton and Sean are no strangers to world record long distance waterskiing. In 1996 they, along with Neville Wilson and Ross Salmon, broke the world record in Australia after skiing a total of 2156 kms in 26 hours 58 minutes and 23 seconds. The skiers broke the previous record for this event by 6 hours 14 minutes and 37 seconds. Since then, the team has faced many personal challenges and losses, including the death of Neville who passed away in January of 2000 from a year long battle with stomach cancer. The Mississippi Challenge is dedicated to him.

Mo

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Skiers Brenton McGrath (left) and his brother Sean.

SCHEDULE

Day 1: June 26
Boom Island,downtown Minneapolis, Minnesota - Dubuque, Iowa

Day 2: June 27
Dubuque, Iowa - Quincy, Illinois

Day 3: June 28
Quincy, Illinois - St. Louis, Missouri

Day 4: June 29
St. Louis, Missouri - Memphis, Tennessee

Day 5: June 30
Memphis, Tennessee - Natchez, Mississippi

Day 6: July 1
Natchez, Mississippi - New Orleans, Louisiana (and the Gulf of Mexico)

Photos of the challenge will be accessible through their web site during the event.

Donations may be sent to:
Challenge Charity Trust
c/o Pete Schenck
6626 Rustic Road
Prior Lake, MN 55372-1423

Source: Mississippi Challenge
Australia Mississippi Challenge web site.
Photo: By Jo Mackey

Forever In Your Wake,

Julie Bostian
Waterskiing / Wakeboarding Guide

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Mississippi River

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cc "Dan Sherburne" <dsherburne@moenviron.org>, "Edward Heisel" <ejheisel@yahoo.com>
bcc
Subject Re: MO WQS MS River Designation - 2

A report prepared by the Corps.

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4.12 -- Recreation

a. General Description

The Mississippi River is a large and diverse area capable of satisfying many recreation needs. The demand for outdoor recreation is continually increasing. Some popular forms of outdoor recreational activities are bicycling, bird watching, camping, fishing, hiking, hunting, power boating, sailing, sightseeing, swimming, and water skiing (See FIGURE 4-57.)

The Mississippi, Illinois and Kaskaskia River segments in the St. Louis District provides major opportunities for water based recreation in the region. Natural vegetation, variable topography, accessibility to water and the proximity of the river to a large population are significant features that enhance its attractiveness for recreational purposes.

b. River Recreation Use Characteristics- Mississippi and Illinois Rivers

Recreational use intensity is a function of the available physical resources, access, management, and proximity of population centers. The recreational resource is dependent on the physical, biological and water quality characteristics of any given segment of the system. These characteristics will determine, to a large extent, the types of recreational activities occurring within any given reach. This relationship will not hold true, however, when access is limited or where high urban concentrations are the major factor in determining recreational use intensity and density.

High public demands for use of these resources in selected reaches of the UMRS (particularly in urban areas) are expected to intensify. Much of the System's shoreline is presently privately owned and large sections of the rivers are paralleled by railroad tracks, impeding access. Furthermore, the majority of public lands along the Rivers are managed for fish and wildlife purposes which may be incompatible with some recreational uses.

Towns and metropolitan areas exert a high demand on the recreational resource. The St. Louis metropolitan area continues to project deficiencies in the availability of access for water-based recreation. This high demand produces intensive use of the resource, especially during weekends and holidays. Conflicts between river users periodically occur during high activity periods, primarily in Pool 26. Major motorboating, sailing, water-skiing and jet-skiing activity occurs in the navigation channel and the main channel border. Major hunting and fishing activity occurs along the main channel border, side channels and backwaters. Camping, picnicking, hiking and nature studies occur primarily on islands, sandbars and along the shoreline.

The expanse of water created by the locks and dams of the navigation project provide additional opportunities for recreation use and enjoyment of the Upper Mississippi River System corridor. Conflicts periodically exist between recreation use and maintenance of the channel and commercial navigation use. Portions of the navigation pools have very shallow areas and stump fields. While these areas provide good fish nursery and waterfowl areas, they are hazards to the boater unfamiliar with the river. Channel structures, such as wing dikes and closing dams, used to help maintain the navigation channel, also present a hazard to the novice or inexperienced boater.

Beaches created with dredged material and by natural deposition receive intensive public use. They provide primitive types of recreation with makeshift facilities. These beaches are used for camping, swimming, sunbathing, picnicking and partying. They form base locations for water skiing, hunting and fishing groups and provide important destination points for recreation visits.

Public access to Navigation Pools 24 - 27 is generally limited to the 49,000 acres of dispersed federally owned shoreline lands, located predominantly in the lower reaches of the pools. The Corps of Engineers, the US Fish and Wildlife Service, the Illinois Department of Natural Resources and the Missouri Department of Conservation manage most of the public access areas and facilities adjacent to the navigation pools. There are also numerous commercial marinas offering public access and other

recreational services, most which are on privately owned shoreline lands.

Opportunities for public access in the open river reach is limited due to private ownership of the shoreline and intervening lands between the highways, railroad tracks, and the river. The most visual identification with the river downsteam of St. Louis occurs at bridge crossings and at river communities. Most of the public land that is available in this reach is located in state parks, state conservation areas, USFWS refuges and Forest Service lands. Roadside parks, points of interest, and city parks comprise a minor amount of the total acreage. Fuel stops for recreational boaters along this reach are extremely limited, forcing most craft to carry extra fuel and provisions.

Regardless of the constraints on the use of the river and related land resources, the existing recreational resources and the cooperative efforts among governmental agencies and private enterprise combine to provide numerous opportunities to experience the diversity of the river's recreational, natural, cultural, and historic values.

Some specific examples of areas with high recreation potentials are: (1) the confluences with major tributaries - the Illinois, the Missouri, the Meramec and the Kaskaskia Rivers; (2) major islands; (3) scenic bluff or river hills areas, e.g. Alton to Grafton Bluffs, Fountain Bluff, and Grand Tower in Illinois, the river hills at Clarksville and Louisiana in Missouri; and (4) the Pere Marquette State Park area along the Lower Illinois River.

None of the Federal or state agencies dealing with outdoor recreation have more than a partial authority for planning and management of the recreational resources. Coordination of planning for public recreational purposes needs to be improved. A Standardized system of collecting recreation use data for the river corridor is non-existent, which impedes the coordination of activities for enhanced recreation opportunities.

Table 4-47
Estimated Ranking of the Top Recreational Activities Pursued in Illinois (SCORP 1994)

1. Pleasure Walking*
2. Pleasure Driving/Sightseeing*
3. Picnicking*
4. Observing Wildlife/Birdwatching*
5. Swimming - Pool
6. Bicycling*
7. Fishing*
8. Swimming - Other*
9. Softball - Baseball
10. Running/Jogging*
11. Motorboating*
12. Golf
13. Hiking*
14. Outdoor Basketball
15. Tennis
16. Tent Camping*
17. Water Skiing*
18. ORV Use
19. Canoeing*
20. Horseback Riding*
21. Vehicle Camping
22. Rock/Fossil Collecting*
23. Hunting*
24. Sailing*
25. Soccer
26. Snowmobiling

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27. Cross Country Skiing*
28. Ice Fishing*
29. Trapping*

Recreational boating use patterns and levels of use for each segment of the Rivers Project Service Area can be realized in relative terms by analyzing Recreational Boat Lockage statistics in the St. Louis District (Table 4-48, FIGURE 4-49, Table 4-9, and FIGURE 4-51.)

A study on the types of recreational boats, projections on boater uses and impacts of recreational boating on the Mississippi and Illinois Rivers is currently being prepared as part of an on-going comprehensive Upper Mississippi and Illinois River Navigation Study being conducted by the Corps. FIGURE 4-52, Table 4-53and FIGURE 4-54 are from this Draft Study and provide a brief summary on the types and sizes of recreational boats utilizing the river in the St. Louis region and existing and projected boat use of the pools in the St. Louis District.

Table 4-48
Total Annual Number of Recreation Boats
at St. Louis District Locks and Dams

Year	Kaskaskia Lock And Dam	Navigation Pool 24	Navigation Pool 25	Navigation Pool 26	Navigation Pool 27
1983	1804	803	1535	625	875
1984	1066	922	1628	897	820
1985	2231	1250	2365	2069	1179
1986	1798	1192	2384	1833	1480
1987	1813	1407	2555	1810	1600
1988	2792	1528	2947	1940	1793
1989	3094	1624	3097	2330	1925
1990	2770	1507	2634	2855	1550
1991	3400	1673	3372	3839	1900
1992	4018	1633	2746	3650	1650
1993	398	227	394	1141	555
1994	3497	1681	3186	4360	1750
1995	6424	1432	2178	6050	1460
1996	6039	1233	2043	4620	1574
1997	7941	1577	2596	3816	1484

FIGURE 4-49 Number of Recreational Boats Locked Through

Table 4-50
1996 Monthly Commercial Tonnage and Commercial and Recreational Lockages and Vessels
(Upbound and Downbound Combined.)

1. Monthly Tonnage:

2. Commercial Lockages:

3. Recreational Lockages:

4. Number of Commercial Vessels:

5: Number of Recreational Vessels:

Month		Kaskaskia	Navigation Pool 24	Navigation Pool 25	Navigation Pool 26	Navigation Pool 27
Jan	1	107,600	156,327	156,327	4,172,850	419,007
	2	71	47	47	365	725
	3	2	0	2	0	0
	4	71	41	36	364	404
	5	4	0	6	0	0
Feb	1	78,400	114,920	130,920	3,137,093	3,404,526
	2	51	37	38	339	382
	3	6	0	0	17	0
	4	51	28	29	339	382
	5	12	0	0	42	1
Mar	1	116,800	2,176,361	2,180,241	6,569,562	7,321,766
	2	58	477	483	650	754
	3	11	3	6	40	2
	4	58	267	270	650	748
	5	23	5	13	86	7
Apr	1	75,200	3,997,624	3,950,559	7,296,618	7,736,976
	2	31	719	717	671	759
	3	46	16	14	134	28
	4	31	386	386	671	759
	5	113	25	29	309	57
	1	75,200	3,575,510	3,672,737	6,437,758	6,851,658

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F 04879

May	2	29	539	667	633	716
	3	72	15	17	113	24
	4	29	336	351	633	716
	5	194	26	40	299	43
Jun	1	65,600	4,718,365	4,498,012	6,856,185	7,267,960
	2	27	736	710	627	719
	3	171	41	59	184	40
	4	26	395	382	627	718
	5	539	81	147	450	80
Jul	1	64,000	5,140,026	5,195,542	7,568,660	8,134,417
	2	39	721	723	649	763
	3	446	115	146	442	183
	4	37	390	390	649	762
	5	1459	279	430	1350	625
Aug	1	96,200	3,465,349	3,502,984	5,689,489	6,125,702
	2	42	445	449	515	584
	3	468	170	224	278	95
	4	41	250	254	515	584
	5	1,948	430	755	745	238
Sep	1	76,800	2,592,310	2,611,565	5,649,651	5,119,862
	2	29	360	364	450	582
	3	291	118	150	303	113
	4	29	210	213	450	516
	5	1,442	264	484	823	290
Oct	1	140,800	3,865,554	3,871,520	7,553,286	7,142,312
	2	77	545	546	676	768
	3	113	53	57	163	86
	4	77	297	298	676	768

	5	279	68	111	412	183
Nov	1	113,600	4,308,747	4,307,892	7,827,281	8,435,991
	2	64	593	591	653	761
	3	9	12	13	43	19
	4	62	324	322	653	761
	5	18	23	27	91	40
Dec	1	99,200	2,067,506	2,017,410	5,883,576	6,216,890
	2	43	271	269	563	711
	3	4	1	0	6	5
	4	43	164	161	563	711
	5	8	2	1	13	10
Cumulative for 1996	1	1,134,600	36,181,599	36,088,706	73,873,169	79,440,582
	2	563	5,590	5,604	6,814	8,543
	3	1,639	544	688	1,723	595
	4	557	3,088	3,092	6,813	7,845
	5	6,039	1,233	2,043	4,620	1,574

FIGURE 4-51
Commercial and Recreational Lockages 1996

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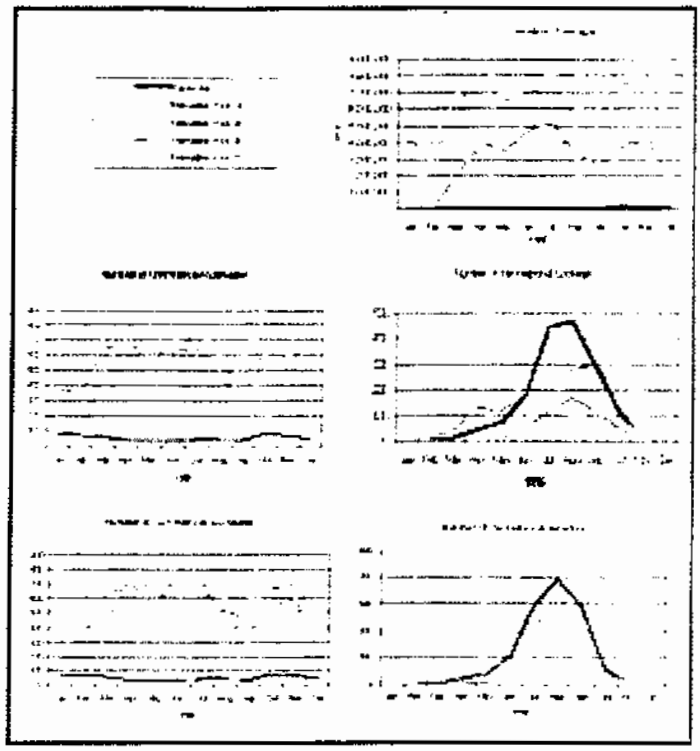


FIGURE 4-52
Boat Observations on the Upper Mississippi River System
Summer 1996 (Gratton, J.)

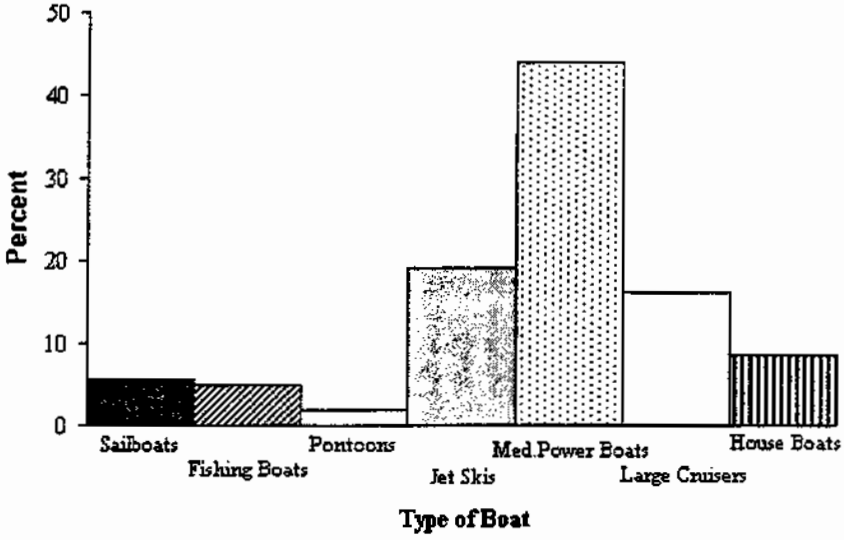


Table 4-53
Distribution of Boats by Length

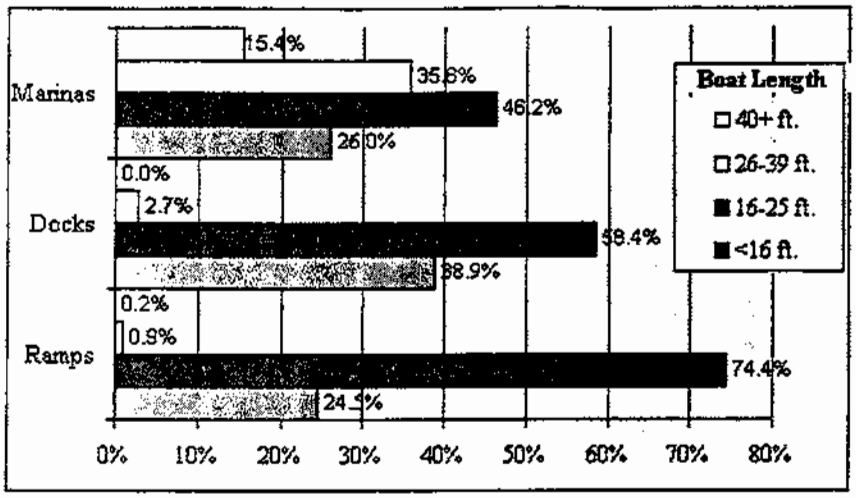
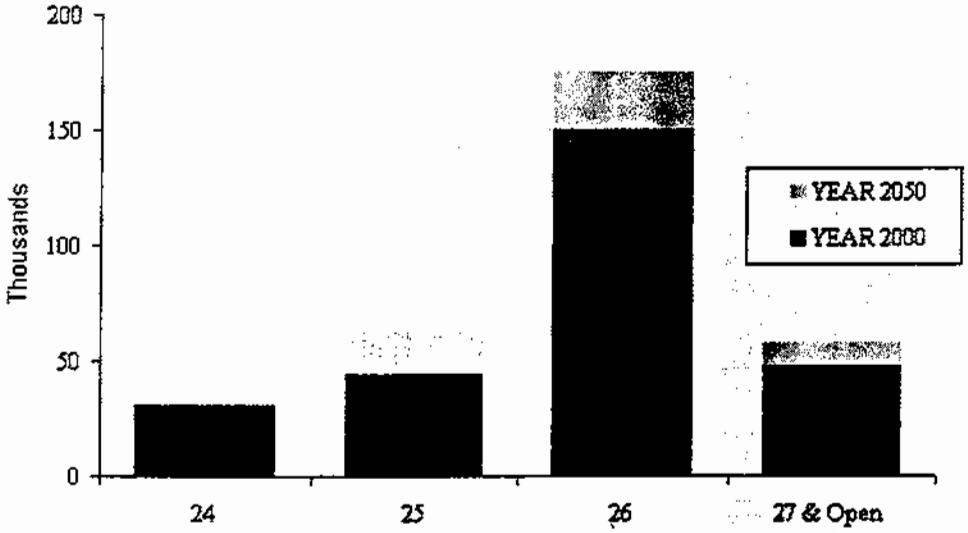


FIGURE 4-54
Boating Use Projections (Unconstrained) St. Louis District



a. Kaskaskia River Navigation Project

Managed by the Illinois Department of Natural Resources, the Kaskaskia River Navigation Project land and water offers a variety of recreational resources. The channelized portion of the river is used heavily for motor boating along with other water-oriented pursuits such as water-skiing, fishing and swimming. The oxbow portions of the river provide a good environment for fishing, hunting and nature studies. The smaller tributaries of the Kaskaskia (Nine Mile, Little Plum, Doza, Silver, Camp, Horse and Richland Creeks) have the potential for providing a suitable canoeing waters.

Heisel, Edward

Fpb99

The Kaskaskia River State Fish & Wildlife Area (KRFWA) is one of the largest state-owned and managed sites in Illinois. Located 35 miles southeast of St. Louis, Missouri, the area comprises more than 20,000 acres of lands and waters and extends along the Kaskaskia River Navigation Project from Fayetteville to the Mississippi River in St. Clair, Monroe, and Randolph counties. The Illinois Department of Transportation acquired the lands along the river and the Department of Natural Resources manages it for fish, wildlife and other recreational activities. Approximately 16,000 acres of public lands and 2,200 acres of Kaskaskia River channel and backwater areas are managed for recreation and environmental stewardship.

Baldwin Lake, a 2,018-acre reservoir built by Illinois Power Company, is managed as part of KRFWA. This lake serves as a source of cooling water in operating a nearby electric generating station. Baldwin Lake is open to the public for fishing and is a major part of the waterfowl refuge of the area.

The Public Land Area along the river includes an extensive mixed bottomland forest comprised of pecan, soft maple, burr oak, pin oak, shellbark hickory, and willow. Many cultivated and fallow fields, native grass patches, brushy areas, and other "open" areas are interspersed with the stands of mature bottomland timber. Due to this great diversity of habitats, good wildlife populations exist in the area and hunting and nature study are popular uses of the KRFWA.

Approximately 14,000 acres are available for hunting of forest game, small upland game and waterfowl. Hunter check stations are maintained in the area and access is primarily from the boat ramps and parking lots.

Fishing is the most popular activity on the Kaskaskia River. With its 36 miles of channelized river, plus additional oxbows, creeks, and river bottom lakes. Channel catfish and flathead catfish , largemouth bass, crappie, bluegill, carp and freshwater drum are the most sought after sport fish.

Concrete launch ramps are provided on the Kaskaskia River at Fayetteville, New Athens, on Highway 154 west of Baldwin, and at Evansville.

Weekends and holidays throughout the summer receive the most recreational boat use and congestion and boater safety is a serious concern.

Primitive camping and picnicking is permitted on lands adjacent to the river and developed picnicking areas are located at Ballwin Lake.

A 12-mile trail system exists and is used by hunters, hikers, birdwatchers and other outdoor enthusiasts.

b. Greenways and Urban Recreation

The St. Louis region was founded and developed around the confluence of five rivers: the Mississippi, Missouri, Meramec, Illinois and Kaskaskia. Over the last 100 years, most of the communities in the region rarely interacted with its rivers. That has changed, however, particularly in the past 10 years as cities are rediscovering their riverfronts for economic and quality of life purposes and leisure time and recreation demand continues to grow. These river corridors are excellent areas to develop Greenways.

Greenway corridors (linear open spaces connecting recreational, cultural, and natural areas) are traditionally recognized for their environmental protection, recreation value and aesthetic appearance. Often, trails and bikeways are the center or core of a

greenway and usually represent the first use, with additional acreage added to solve environmental problems or to enhance the aesthetic qualities, natural habitat and recreation opportunities.

Greenway users typically think of biking, hiking, canoeing or fishing, but there are other benefits. By forestalling floodplain development, they reduce the damage caused by flooding. They provide natural filters that help trap and break down pollutants. They also provide places for plants and animals to live and travel through. Trees along greenways can shield unsightly land use, repair past land abuses or act as barriers from the sound of traffic on highways. These linear corridors can link parks, natural reserves, cultural features and historic sites so that people can enjoy the synergistic effect of these links.

Greenways and trail corridors in the region include:

a. The Katy Trail, a 200-mile trail that parallels the Missouri River through the region and is part of the coast-to-coast American Discovery Trail.
b. The Confluence Bikeway, a twenty-four-mile trail from Alton to Locks 27 that will connect with the Chain of Rocks Bridge and wetlands along the Mississippi River.
c. The Riverfront Trail, a twelve-mile trail in Missouri from the Gateway Arch north to the Chain of Rocks Area.
d. The Levee Trail, eleven miles along the Illinois levees from the Eads Bridge through Cahokia and on toward Belleville.
e. Grant's Trail, a six-mile trail and greenway near Grant's Farm and the Ulysses S. Grant National Historic Site.
f. Meeting of the Great Rivers National Scenic Byway which includes the 30-mile Vadalabene Bikeway and adjacent viewsheds are being preserved by the Great Rivers Land Trust.
g. Columbia Bottoms, a large 4,300 floodplain previously owned by the city of St. Louis transferred to the Missouri Department of Conservation as part of a large greenway along the river in 1997.
h. The Meramec River Greenway, a twenty-year old effort to protect the green corridor and its adjacent floodplains along the Meramec River.
i. The River Des Peres, winding through south St Louis. The flood of 1993 destroyed many homes along this corridor and those properties are being returned to open green spaces.
j. The Limestone Bluffline, a corridor from Alton to Chester that connects natural area bluff communities.

Plans to protect additional greenways in the region are being pursued through partnering by various federal, state, county and municipal agencies and non-profit organizations such as the St. Louis based trail advocacy group, TRAILNET. The St. Louis District is involved in several of these greenway efforts associated with existing Corps projects and lands and waters.

c. Marina Developments

Private and commercially owned and operated marinas located on private lands are listed in Table 4-55. Pool 26, because of its location in the metropolitan area, has the largest number of marinas and marinas of the largest size. Only a few leased marina services are located on public lands. These areas are listed on Table 4-56.

Table 4-55
Private Recreational Marina and Boat Club Developments (On Private Lands/Waters)

Map ID Number	Marina or Other Facility Name	State, County, City	River Mile and Bank	No. of Slips or Facilities	Services and Features
a.					

Heisel, Edward
F p 7 8 9

	POOL 24				
24-2	Louisiana Boat Club	MO, Pike, Louisiana	283 R		
24-3	Clarksville Boat Club	MO, Pike, Clarksville	273.2 R		
	POOL 25				
25-1	Riverport Marina	MO, Pike,	260 R		
25-2	Timberlake Marina	MO, Lincoln, Elsberry	257.7 R	50 Slips, 40 Campsites	Camping- 11 Cabins
25-3	Channel Park Harbor	MO, Lincoln	257 R		
25-4	Stay and Play Marina	MO, Lincoln	245.2 R		
25-5	Pirys Marina	MO, Lincoln, Winfield	241.5 R		
	POOL 26				
26-1	Johns Boat Harbor	MO, St. Charles	231.5 R	100 Slips	
26-2	Two Branch Marina	MO, St. Charles	231.5 R		
25-3	Club Holiday Boat Harbor	MO, St. Charles	230.2 R		
25-4	Dardenne Boat Harbor	MO, St. Charles	227.5 R		
26-5	South Shore Marina	MO, St. Charles, Kampsville	227.0 R	80 Slips	
26-6	Yacht Club of St. Louis	MO, St. Charles	225.5 R	190 Slips	
26-7	Lake Center Marina	MO, St. Charles,	224.5 R		
26-8	Heartland Marina	MO, St. Charles,	223.5 R		
26-9	Woodland Marina	MO, St. Charles, St. Charles	222.5 R	470 Slips	
26-10	North Shore Yacht Club	MO, St. Charles, St. Charles	222.3 R at Hinge Point	185 Slips	
26-11	222 Yacht Club	MO, St. Charles,	222.0 R		
26-12	Anchor Marine	MO, St. Charles	221.5 R	103 Slips	
26-13	Duck Club Yacht Club	MO, St. Charles	221.5 R	114 Slips	
26-15	Hideaway Harbor	MO, St. Charles, Portage Des Sioux	214.0 R	60 Slips	
26-17	Snug Harbor	MO, St. Charles, Portage Des Sioux	213.5		
26-18	Sioux Yacht Club	MO, St. Charles, Portage Des Sioux	213.4		
26-19	Venetian Harbor	MO, St. Charles, Portage Des Sioux	213.7 R	160 Slips	
26-20	Sioux Harbor	MO, St. Charles, Portage Des Sioux	213.0 R		
26-21	Palisades Yacht Club	MO, St. Charles, Portage Des Sioux	212.5 R	67 Slips	
26-21	My River Home Boat Harbor Inc.	MO, St. Charles, Portage Des Sioux	212.4 R	200 Slips	
26-22	Valley Sailing Association	MO, St. Charles	211.5		
26-23	St. Louis Sailing Club	MO, St. Charles	211.6		

a.

26-25	Harbor Point Yacht Club	MO, St. Charles, West Alton	204.3 R	226 Slips	
26-25	Pilot House Yacht Club	MO, St. Charles, West Alton	204.2 R	225 Slips	
	OPEN MISSISSIPPI RIVER				
O-1	Hoppies Marina	MO, Jefferson, Kimmswick	158.2 R		
O-2	Marina De Gabouri	MO, Ste. Genevieve, Ste. Genevieve	122.0 R		
	LOWER KASKASKIA RIVER				
K-1	Kaskaskia River Marina	IL, St. Clair, New Athens	30 L	50 Slips	27 Campsites, Shipstore, Restaurant, Boat Services

a.

Table 4-56
Commercial Concession Recreational Marina and Boat Club Developments on Public Lands

Map ID Number	Marina or Other Facility Name	State, County, City	River Mile and Bank	No. of Slips or Facilities	Services and Features
POOL 24					
24-1	Two Rivers Marina	IL, Pike,	283.0 L		
POOL 25					
25-6	Calhoun Sportsman Club	IL, Calhoun, Batchtown	242.0 L		
POOL 26 (Including Illinois River)					
26-14	Sherwood Harbor	MO, St. Charles,	219.0 R		
26-24	Alton Boat Club	IL, Jersey,	209.5 L Up Piasa Creek		
26-24	Piasa Harbor	IL, Jersey,	209.5 L		
26-26	The Alton Marina	IL, Madison, Alton	202.0 L	182 Slips	

a. Recreational Uses and Economic Significance on the UMRS

The value of the Upper Mississippi River System (UMRS) as a nationally significant resource is widely recognized. The system is vital in supporting ecological systems, commercial navigation and a wide variety of recreational activities.

In order to learn more about the types and economic significance of recreational use of the UMRS, Congress authorized a study in 1986 (Public Law 99-88) to measure the economic importance of recreation in the UMRS. The study was fully completed and published in April 1995.

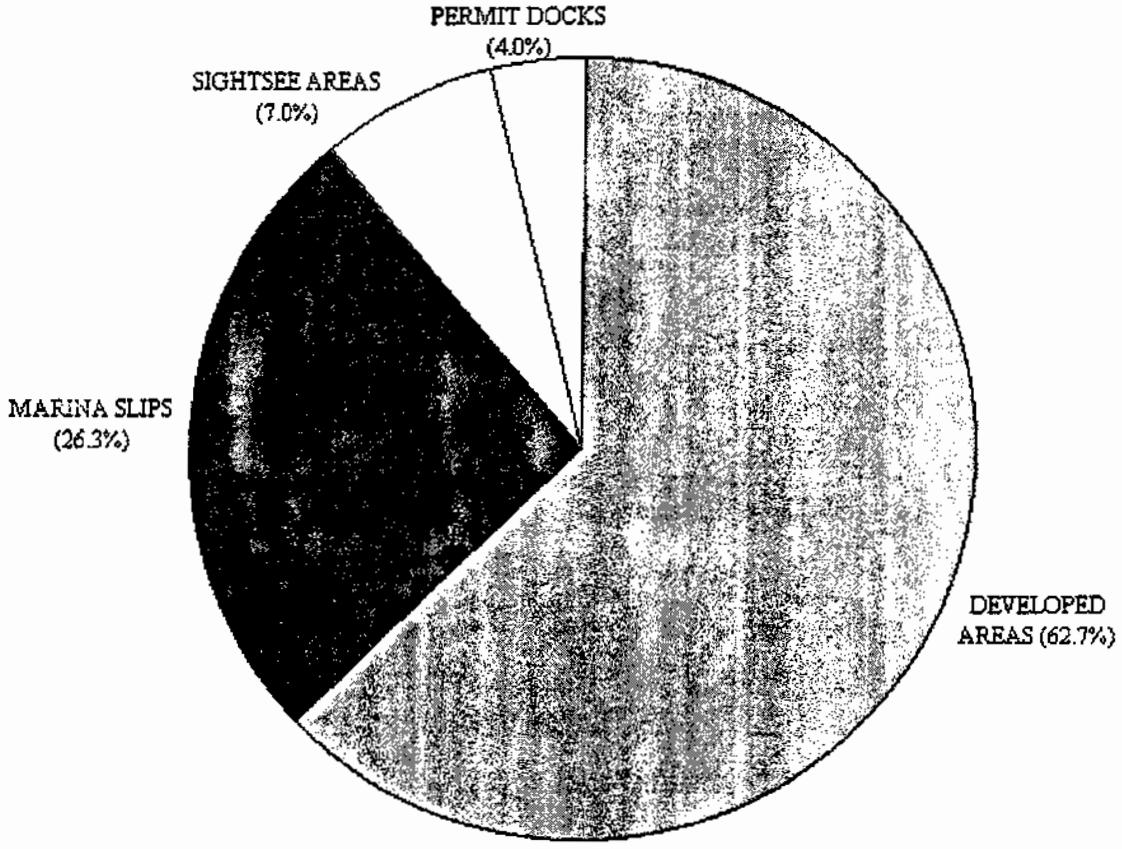
In summary, the study estimates that throughout the UMRS over 12 million daily visits by recreationists took place during the study year. These visits resulted in direct and secondary expenditures of over $1.2 billion that helped maintain over 18,000 jobs.

Heisel, Edward
F. p 8 of 9

Other study findings of relevance to the Rivers Project area are as follows:

a. More than 2.3 million recreational party trips to the UMRS were made to developed areas, sightseeing/visitor center areas, marinas and permitted docks during the study period. These trips equate to over 12 million daily visits by recreationists.
b. Boating, fishing and sightseeing were the most popular activities. Half of all visitors boated.
c. Over 60% of the people made their trips to developed public recreation areas, with the remaining trips being made to marinas (26%) (primarily on private lands), sightseeing/visitor center areas (7%) and permitted docks (4%).
d. Residents of counties that border the UMRS accounted for the majority of the trips, ranging from two-thirds to three-fourths for all types of access. Single day trips were predominant (around 75%) when compared with trips that included overnight stays. Average party sizes were larger for trips to permitted docks and marinas.

FIGURE 4-57
Recreational Use of the Upper Mississippi River System by Access Types Surveyed



Types of Recreational Access Not Included in the Study were:
Dispersed use areas/undeveloped areas
Urban river corridor parks and Greenways (unlimited access)
Private clubs (hunting, etc.)
Riparian households without permitted docks
Commercial boat tours/Gambling boats
Boaters who Pass through the entire UMRS

a. Visitors spent over $190 million on items consumed on trips during the study

year. Spending on durable items amounted to over $150 million during the study year. The average spending per visitor per day for items consumed on trips was $15.84. Most of this spending was for food, gas, lodging, and boating expenses.

Patterns in spending were evident. The most influential factors were distance traveled, length of trips (daily or overnight), and use or nonuse of boats. These patterns have been identified in "expenditure profiles" and can be used in future studies in the UMRS.

b. Spending on durable items used on trips, such as boats and fishing gear, averaged $12.54 per visitor per day. Most of this spending was on boating equipment, camping vehicles, and fishing gear.
c. Visitors to marinas spent more, on average, than visitors to other areas. The value of all boats in marinas was approximately $600 million.
d. Recreational activity on the UMRS during the study year resulted in direct and secondary expenditures of $1.2 billion that helped maintain 18,500 jobs nationwide.
e. Recreational activities in the 76 counties bordering the UMRS during the study year resulted in direct and secondary expenditures of $400 million that helped maintain 7,200 jobs. Service industries, retailers, manufactures and finance and insurance providers were affected most.
f. One third of all spending in the 76 corridor counties was made by nonresidents, representing "new dollars" to the region.

FIGURE 4-58
Summary of Recreational Activities for Entire UMRS

Heisel, Edward

FP 989

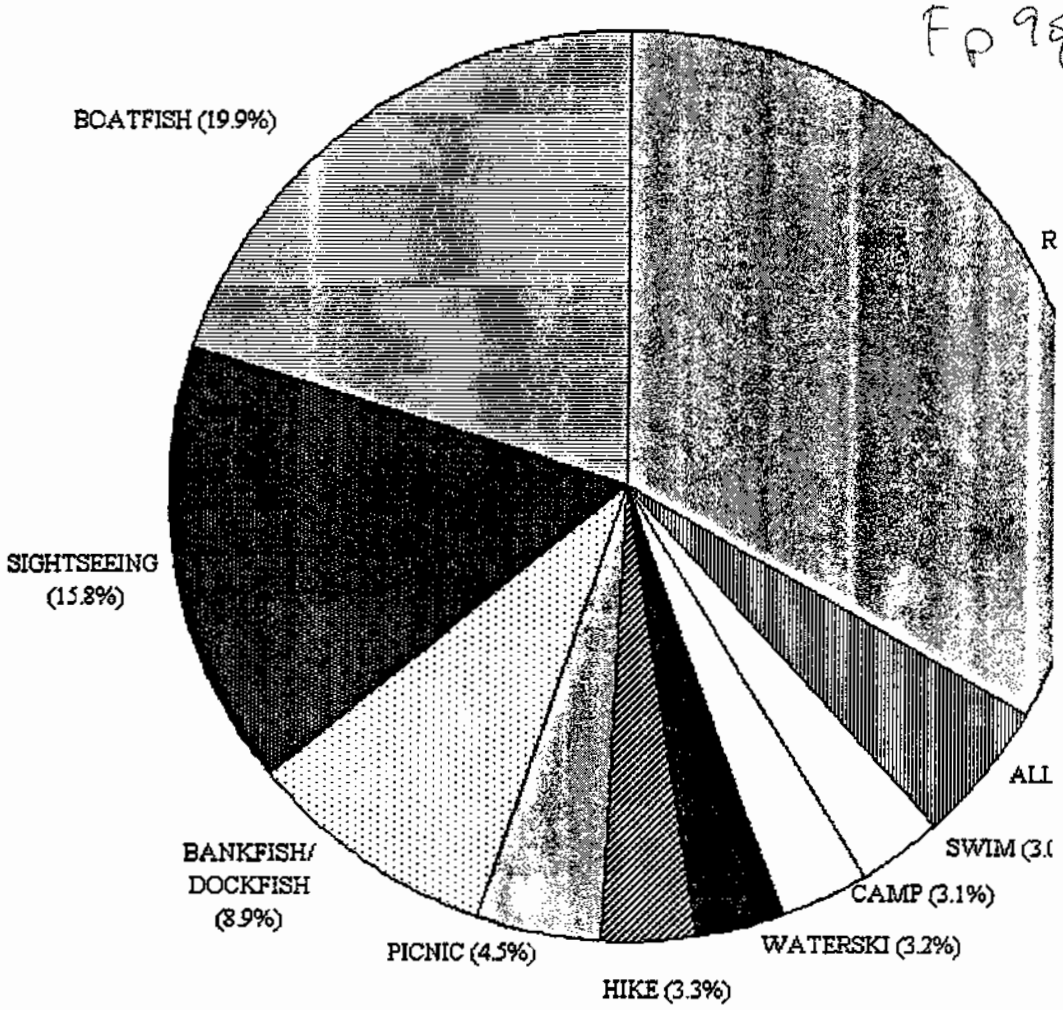
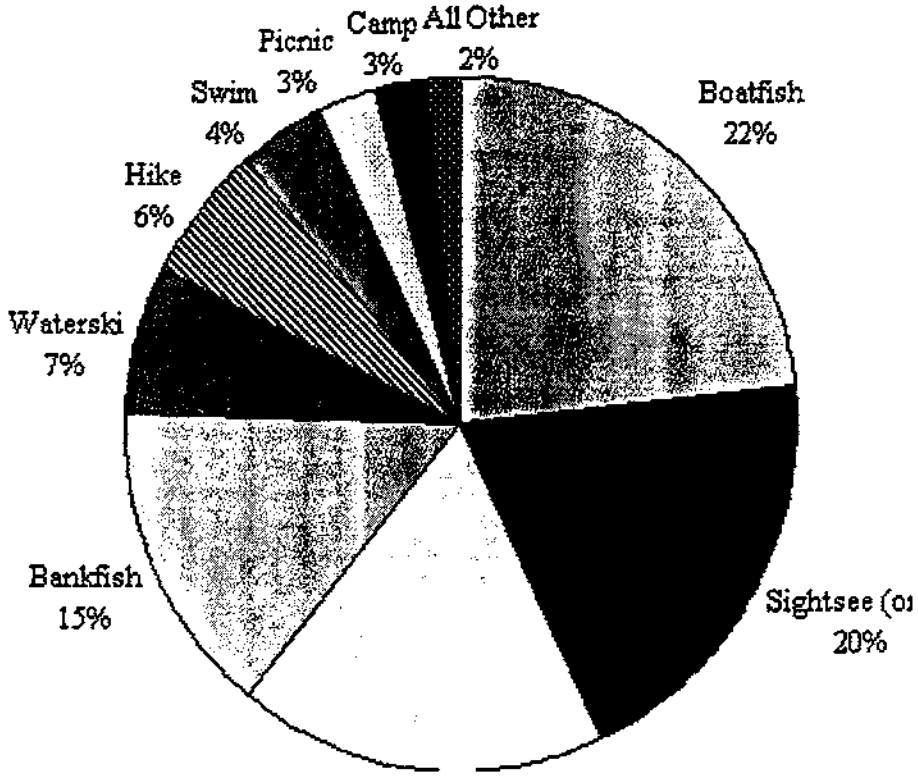


FIGURE 4-59
St. Louis District Recreational Activities Based on Surveys



Continue to Section V - Partnerships and Coordination

Return to Section IV Contents

Mississippi R

Heissinger, Heinrich

"Heinrich Heissinger"
<heihk75@hotmail.com>

10/29/2005 12:58 PM

To stacia.bax@dnr.mo.gov
cc
bcc
Subject clean water

I understand that a large stretch of the Mississippi River near St. Louis and its tributaries Des Peres River and Maline Creek have been exempted from new state water quality rules.

I grew up in Europe, and back then the Rhine River was totally polluted and without fish. Over the past 30 years it was cleaned up to the point that Salmon have returned to the Rhine.

We should clean up our rivers also, and keep them clean. Let's face it, sooner or later we will be forced to do so anyhow out of concern for the health of our population. The longer we wait, the more difficult and costly it will be.

Please be supportive of this cause,

Dr. Heinrich K. Heissinger
618 Dougherty View CT
Des Peres
MO 63131-2214
314 / 821 5270

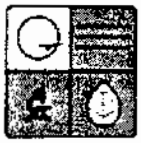
PS: I use the Missouri River recreationally, mainly for fishing.

Mississippi River Misissippi River - Stacia Bax/WPCP/DEQ/MODNR Lackey, Pat

"Pat Lackey"
<lackeys@prodigy.net>
10/31/2005 09:28 AM

To stacia.bax@dnr.mo.gov
cc
bcc
Subject Misissippi River

Dear Stacia,
There are thousands of us who boat,ski and swim in the Miss River. Are you talking about exempting from below the Meramac, or precisley at what stage of the Mississippi ?
thanks
Pat Lackey



Stacia Bax/WPCP/DEQ/MODNR
11/01/2005 03:53 PM

To "Pat Lackey" <lackeys@prodigy.net>
cc
bcc All Message Store@MODNR
Subject Re: Mississippi river

Good Afternoon,

The Mississippi River is designated for whole body contact recreational use from Dam #27, which is in St. Louis City, around the Chain of Rocks area up to the state line with Iowa.

We are seeking comments from St. Louis City down to where the Ohio River enters the Mississippi (near Charleston, MO/Cairo, IL).

Do you have any specific times and locations where you or others have recreated on the Mississippi River below Dam #27 to the Ohio River? Recreational activities include swimming, water skiing, skin diving, fishing, trapping, boating, canoeing, kayaking, wading, etc.) An example could be, "I have seen people swim near Holiday Island at mile marker XYZ near Wittenberg, MO every weekend from May to September since 1985." The more specific the better.

The comments you make will be added to the other comments we will receive. They will be presented to the Missouri Clean Water Commission at their meeting in January 2006. If you would like more specifics about the meeting and its results, just let me know. We will also be submitting all comments received to the U.S. Environmental Protection Agency for their consideration.

As more citizens, like yourself, tell us their comments, the better we can manage the water resources of the state.

Thank You.
Stacia Bax
Environmental Specialist
MDNR, Water Quality Monitoring & Assessment Section
573-526-7838
"Pat Lackey" <lackeys@prodigy.net>

"Pat Lackey" <lackeys@prodigy.net>
11/01/2005 09:54 AM

To stacia.bax@dnr.mo.gov
cc
Subject mississippi river

what section of the mississippi river are you
proposing to exempt from clean water standards ?
thanks, Pat Lackey 314-991-4211

Mississippi River

Leppo, Norman

NORMAN B. LEPPO
3011 COLEMAN AVENUE
ST. LOUIS, MISSOURI 63143-3607

November 11, 2005

Ms. Stacia Bax
Use Attainability Analysis Coordinator
Missouri Department of Natural Resources
P.O. Box 176
Jefferson City MO 65102-0176

Dear Ms. Bax:

I write to urge the Clean Water Commission to delete any portion of the Mississippi River from the "whole body contact" exempt list. While I do not personally enter that river or traverse it, I am well aware of others who do.

Multiple times have there been stories, photographs and articles in the St.Louis Post Dispatch newspaper about people canoeing , or traveling in small craft, over various lengths of the Mississippi. Some have been covered by the local television stations. I have seen people fishing and boating in the portion down stream from the arch, as I have driven on roads which parallel, or approach, the river in close enough proximity to allow such viewing. I am not familiar enough with the specific geography to be very definitive; but the limitation to "road viewing" should provide some narrowing as to location.

While I have not personally observed swimming in that portion of the river, it is unreasonable to speculate that is does not happen. People are naturally drawn to water, and, given the opportunity, in most instances, they will swim in it. Although the Commission's responsibility may be restricted to that portion of the Mississippi which abuts the state of Missouri, surely there must be an implied responsibility to those who are downstream and their similar use of the water which flows first along our border, just as the same should apply to those states north of Missouri which border the Mississippi.

It certainly seems obvious to me that keeping all waterways safe for "whole body contact" shouldn't even be a debatable issue.

Sincerely,

Norman B. Leppo

Norman B. Leppo

SAINT LOUIS MO 631

12 NOV 05 PM 05 L

Ms. Stacia Bax
Use Attainability Analysis Coordinator
Missouri Department of Natural Resources
P O. Box 176
Jefferson City MO 65102-0176

65102+0176

Mississippi River

Light, Joe
p 162

7026 Sutherland Ave
St. Louis, MO 63109
November 6, 2005

Stacia Bax
Use Attainability Coordinator
P.O. Box 176
Jefferson City, MO 65102-0176

Dear Stacia,

I recently sent you a letter regarding my use of the River Des Peres and the whole body contact provision of the Clean Water Act. I would like to inform you of my use of another river that is threatened, the Mississippi River.

It is my understanding that the Mississippi River below Lock and Dam 27 to the Ohio River will be exempt from the disinfection standards.

This concerns me, because I am a user of this river. I have canoed the Mississippi River from the Chain of Rocks (City of St. Louis) to Cliff Cave Park (St. Louis County). Enclosed are several pictures of me and my friends, canoeing this part of the river in the September of 2003.

When you canoe a river, you can try your best to avoid the water, but by the end of the trip, you are full exposed/covered by the waters of the river.

I plan on canoeing the Mississippi River to Cape Girardeau in the near future. Since this river is a health risk to me and the public, I ask you to keep the "Whole Body Contact" designation for the Mississippi River.

If you have any questions, regarding my use of the Mississippi, please contact me at the address above, by phone at 314-644-7071, or via email at Joe@JoeLight.com

Sincerely,

Joe Light

Mississippi River below Chain of Rocks Summer 2003 by Joe Light

Mississippi River above the downtown waterfront. Summer 2003 by Joe Light

Light, Joe
p 282

Mississippi River, St. Louis County, North of 255 Summer 2003 by Joe Light

J. Light
7026 Sutherland Ave
St. Louis, MO 63109

SAINT LOUIS MO 631
07 NOV 05 PM 01 T

Stacia Bax
Use Attainability Coordinator
PO Box 176
Jefferson City MO 65102-0176

65102-0176

Lodderhose, John - A. pl & 2

Phil Schroeder/WPCP/DEQ/MODNR
08/02/2005 07:59 AM

To: Mohsen Dkhili/WPCP/DEQ/MODNR@MODNR, Stacia Bax/WPCP/DEQ/MODNR@MODNR
cc:
bcc:
Subject: Fw: Comments on Water Quality Standards Rule

FYI.
----- Forwarded by Phil Schroeder/WPCP/DEQ/MODNR on 08/02/2005 07:59 AM -----

"John Lodderhose" <JRLODD@stlmsd.com>
08/02/2005 07:28 AM

To: phil.schroeder@dnr.mo.gov
cc:
Subject: Re: Fw: Comments on Water Quality Standards Rule

No recreational use and unsafe conditions. I am trying to get a copy of the report and will share it with you.

John R. Lodderhose, P.E.
Assistant Director of Engineering
Environmental Compliance
(314) 436-8714

>>> "Phil Schroeder" <phil.schroeder@dnr.mo.gov> 8/1/2005 4:28:52 PM
>>>
What was the waiver based on?

"John Lodderhose" <JRLODD@stlmsd.com>
08/01/2005 04:20 PM

To
phil.schroeder@dnr.mo.gov
cc

Subject
Re: Fw: Comments on Water Quality Standards Rule

Phil, we should have mentioned in our Mississippi River UAA that American Bottoms in Sauget, IL has a year-round waiver to disinfection from IEPA. They discharge to the Mississippi River directly across from
St. Louis.

John R. Lodderhose, P.E.
Assistant Director of Engineering
Environmental Compliance
(314) 436-8714

>>> "Phil Schroeder" <phil.schroeder@dnr.mo.gov> 8/1/2005 9:41:39 AM

>>>
FYI. Relates to our conversation this morning.

----- Forwarded by Phil Schroeder/WPCP/DEQ/MODNR on 08/01/2005 09:40 AM

Marlene Kirchner/WPCP/DEQ/MODNR
08/01/2005 09:31 AM

To
Phil Schroeder/WPCP/DEQ/MODNR@MODNR, Stacia Bax/WPCP/DEQ/MODNR@MODNR, Linda Mebruer/WPCP/DEQ/MODNR@MODNR
cc

Subject
Fw: Comments on Water Quality Standards Rule

Marlene Kirchner
Program Secretary
Water Protection Program
(573) 751-6721
----- Forwarded by Marlene Kirchner/WPCP/DEQ/MODNR on 08/01/2005 09:31 AM

"Edward Heisel" <ejheisel@yahoo.com>
07/31/2005 04:07 PM

To
"Marlene Kirchner" <marlene.kirchner@dnr.mo.gov>
cc

Subject
Comments on Water Quality Standards Rule

Dear Ms. Kirchner:

The comments relate to the draft water quality rule and the proposed recreational designation for the Missouri and Mississippi rivers. The

DNR's recommendation was "inconclusive" as to the proper recreational use
of these rivers.

I am a frequent user of the Missouri River, most often in my kayak in the
reach bounded by St. Louis County, Missouri. While on these regular trips, I am regularly sprayed with mist from my paddles and the wind, sometimes to the point of becoming soaked with river water. River

water
regularly comes into contact with my face and upper body when seated in
my
kayak. I kayak on the river throughout the year when the temperature allows, including several times earlier this year when the river approached 100,000 cfs at St. Charles.

I also enjoy wading along sandbars in the river. On one occasion, I swam
in the river, as that term is commonly understood (i.e. full body submersion), in slow moving water near a sandbar. When the river is low
(i.e. less than 50,000 cfs at St. Charles) there is an abundance of places
on the lower river where it would be safe and enjoyable to swim as a result of shallow depths, slow current and a sandy substrate. I would

swim more often in the river if I was confident that pollution levels were
meeting water quality standards designed to protect recreational uses.

I also regularly kayak on the Mississippi River in St. Louis County and
in
New Madrid County, similarly getting sprayed with river water, and wading
in shallow water near sandbars. On two occasions I have floated on the

Mississippi River at New Madrid when it was at or near flood stage. I

would engage in more extensive contact with Mississippi River water if I
were more confident that it was meeting recreational standards.

Please place these comments in DNR's record pertaining to appropriate recreational use designations. Thank you.

Ted Heisel
7564 Wise Avenue
St. Louis, MO 63117
314.401.6218

Metropolitan
St. Louis Sewer
District

Division of Environmental Compliance
10 East Grand Avenue
St. Louis, MO 63147-2913
(314) 436-8710
FAX (314) 436-8753

Lodderhose, John
Bpl 827

August 23, 2005

Ms. Marlene Kirchner
Secretary, Missouri Clean Water Commission
P.O. Box 176
Jefferson City, MO 65102

Re: Supplemental Information for the Mississippi River Whole Body Contact Use Attainability Analysis (Missouri Water Body Identification #1707)

Dear Ms. Kirchner:

The purpose of this correspondence is to clarify the findings of the Mississippi Whole Body Contact Recreation (WBCR) Use Attainability Analysis (UAA), prepared by MEC Water Resources, Inc. (MEC). This UAA was submitted to the Missouri Department of Natural Resources (MDNR) on July 14, 2005. The UAA report recommended removal of WBCR use from the Missouri Department of Conservation Riverfront Park Access to the Meramec River confluence, due to hydrologic modifications that prevent use attainment. Hydrologic modifications, primarily channelization, result in high volume of barge traffic and high water velocities that prevent WBCR use attainment.

MDNR reviewed this report and interpreted the findings as "inconclusive". The MDNR indicated that the study does not conclusively show that uses are unattainable. The following information and the attached reference report are provided to clarify the study findings and support conclusive use attainability decisions.

Intense barge traffic produce dangerous conditions for WBCR uses within the segment recommended for WBCR use removal. The Port of Metropolitan St. Louis is considered the second busiest inland port in the United States. According to the United States Army Corps of Engineers, approximately 10,000 vessels towing 75,000 barges pass through the St. Louis metropolitan area, many of which utilize the numerous Mississippi River terminals and docks within the St. Louis area. Barge traffic is highest during summer and fall (exceeding 1,700 vessels in July), which coincides with the peak potential recreational season. Barge traffic is diverted around the Chain of Rocks through the Chain of Rock Canal, upstream of the segment recommended for WBCR use removal. This routing of barge traffic allows kayaking use of the Chain of Rocks area, which was indicated within the report.

The hydrologic modifications (channelization) of the Mississippi River also produce high velocities that may prevent attainment of swimming uses. According to the United States Fish and Wildlife Service, optimal water velocities for swimming range from 0.25 to 0.75 feet per second (fps) while those exceeding 2 fps are considered marginal and unsafe at

velocities greater than 3 fps. This supporting document is attached for informational purposes.

The UAA found that unsafe swimming conditions (as indicated by mean channel velocity) are exceeded approximately 85% of the time, corresponding to flows above approximately 105,000 cubic feet per second. Marginal swimming conditions (based on velocity boundaries) are exceeded throughout the range of observed flows at the Mississippi River St. Louis gage. Therefore, we recommend removal of WBCR use due to hydrologic modifications that prevent use attainment based upon these findings.

We understand that the State of Illinois also considers the Mississippi River segment within the Metropolitan St. Louis area unsafe for WBCR uses. The Illinois Environmental Protection Agency (IEPA) granted a disinfection waiver to the American Bottoms Regional Wastewater Treatment Facility in Sauget, IL, based upon safety factors and lack of recreational use on the Mississippi River in the Metropolitan St. Louis area.

In addition to this UAA factor, substantial and widespread social and economic impacts may prevent WBCR use attainment. If necessary, we will submit information on these UAA factors when available.

The Metropolitan St. Louis Sewer District sincerely appreciates the efforts expended by MDNR and the Missouri Clean Water Commission related to the Mississippi UAA.

Sincerely,

Metropolitan St. Louis Sewer District

John R Lodderhose

John Lodderhose, P.E.
Assistant Director of Engineering
Environmental Compliance

C: Tom Hermann
Ed Galbraith
Phil Schroeder

Lodderhose, John
B p2827

FWS/OBS-78/34
June 1978

METHODS OF ASSESSING INSTREAM FLOWS FOR RECREATION

Instream Flow Information Paper No. 6

by

Ronald Hyra[1]
Cooperative Instream Flow Service Group
Creekside Building
2625 Redwing Road
Fort Collins, Colorado 80526

This study was financed in part through the Water Resources Council under provisions of the Federal Non-Nuclear Energy Research and Development Act of 1974

Cooperative Instream Flow Service Group
Western Energy and Land Use Team
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U.S. Department of the Interior

[1]Detailed to the Cooperative Instream Flow Service Group from the Heritage Conservation and Recreation Service.

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ABSTRACT

The Instream Flow Group (IFG) has conducted research into methods of quantifying instream flow needs for fish, wildlife, and recreation. This paper describes two techniques developed by IFG for performing recreational instream flow studies. The single cross section method is relatively simple and provides a base flow figure which will provide for the boating activities which make use of the of river. The incremental method is more sophisticated and may be used to develop recommendations regarding streamflows required for various types of recreation, or to provide a recreation analysis of any streamflow. Streamflow suitability criteria for recreation are presented for both methods.

INTRODUCTION

It has been long recognized that there are many competing demands for the use of stream water. Diverting stream water for irrigation, water supply, and energy developments can deplete streamflows to the point where opportunities for recreation and the associated environmental values of the stream are seriously impaired. Numerous water planning studies, both basin-wide and project oriented, have emphasized the need to quantify the amount of water required to support recreation, fish and wildlife resources, and to maintain aesthetic conditions.

The tools and techniques for estimating streamflows required for recreation and aesthetics, and for insuring reasonable consideration of recreation and aesthetics in the allocation of stream water, are currently undergoing study. Instream flow requirements and values for recreation, in the past, have often been based only upon the amount required to maintain a fishery. However, several studies have indicated that recreation and aesthetic requirements, at times, may not be the same as for a fishery.

This paper presents the techniques of assessing instream flows for recreation. These techniques were developed by the Cooperative Instream Flow Service Group and closely parallel techniques used to assess instream flows for fisheries. The data collection procedures, the physical and hydraulic simulation of the stream, and the computer models which analyze the data are the same for both fisheries and recreation. The major difference between the two techniques is the response of the individual fish or recreationist to various physical parameters of

stream flow. These responses to stream flow by different user groups are the criteria which are basic to the methods introduced here.

The first method is called the single cross section approach. This method is useful primarily for identifying flows below which a recreation activity is not feasible and results in a so called "minimum" flow recommendation.

The second method is called the incremental method. With this method the recreation planner is able to analyze various flows and determine the recreation potential of a stream at different flows.

This paper is being distributed with four objectives in mind. These are:

1. To bring the problem of preserving instream flows to the attention of recreation agencies and the research community in order to encourage more research in this vital and neglected area.

2. To discuss the development of the recreation probability-of-use curves and of recreation criteria in general, which are necessary for quantifying instream water requirements for recreation.

3. To obtain review and comment on the recreation criteria and probability-of-use curves, and to request data which may be used to test or improve the criteria or curves.

4. To describe the two approaches for assessing stream flows and discuss how various recreation planning processes can be served by their application.

Both methods of instream flow analysis discussed in this paper utilize computer modeling techniques. Both approaches also require that streamflow data be collected. The single cross section approach, as its name implies, requires that information be collected at only one location on the stream. The incremental method requires that data be collected at multiple locations on the stream. In addition to cross sectional data, data relating the streamflow parameters to recreation potential are necessary. These data are termed recreation criteria.

Recreation criteria for instream flow methodologies are the recreation activity information bases necessary to describe a relationship between the quantity of water flowing in a stream, and the quantity and

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quality of a particular recreation activity which takes place in the stream.

SINGLE CROSS SECTION METHOD

This method requires that only a single cross sectional measurement be taken across a stream. The product of such an approach is a determination of the lowest flow acceptable for recreation. The approach is based on the assumption that a single cross section, properly located, can define a minimum flow requirement. Such a cross section is located at an area displaying the least depth across the entire stream. When this area provides minimum depths for boat passage, the flow at this level may be defined as a minimum acceptable flow. It is assumed that when sufficient water to support boating is available in these critical areas, other areas will have sufficient water to support most of the other instream recreation activities. This approach is best applied to those streams in which flows are expected to be higher than the minimum most of the time.

Criteria for this approach are set forth in Table 1. Criteria have been developed for boating activities only, but for various types of boating craft. Only minimum criteria are presented because this approach provides information on "minimum flows." Criteria are measured in terms of stream depth and width. Velocity is not considered because a minimum velocity is not considered necessary for this approach.

Table 1. Required stream width and depth for various recreation craft as determined by single cross section method.

Recreation Craft	Required depth (ft)	Required width (ft)
Canoe-kayak	0.5	4
Drift boat, row boat-raft	1.0	6
Tube	1.0	4
Power boat	3.0	6
Sail boat	3.0	25

The criteria of Table 1 are minimal and would not provide a satisfactory experience if the entire river was at this level. However, the cross section measured for this method is the shallowest in the stream reach. Therefore, these minimum conditions will only be encountered for

a short time during a boating trip, and the remainder of the trip will be over water of greater depths and widths. An important assumption is that all water greater than the minimum is equally useful for the activity (i.e., more is better until bank-full stage).

A computer program (IFG-1) has been developed which predicts width and depth across the transect of any stage (water surface elevation). The output shows discharge and the width with depth equal to or greater than a specific depth. Different water surface elevations may be put into the computer model which are translated into flow in cubic feet per second. When a flow provides the minimum width and depth necessary for an activity, discharge may be considered minimum. Such a minimum indicates that significant losses, if not elimination of this activity, will occur if minimum flow is not equaled or exceeded.

THE INCREMENTAL METHOD

This method, more sophisticated than the single cross section method, describes a relationship between the amount of water in a reach of stream and the associated recreation potential. The incremental method can describe the potential for any recreation activity at any streamflow. A major difference between the methods is that the single cross section method can only be used to identify low flow and cannot be used to assess the recreation potential at any other flow; the incremental method can be used to assess the potential at other flows or to calculate the change in receation potential caused by a change in stream flow.

The incremental method involves a modeling procedure whereby the surface area of a stretch of stream is calculated. In addition to the total surface area of the reach of stream, the area which has certain depths and velocities is calculated. The usable surface area for each activity is then calculated by use of depth and velocity requirements.

It is necessary to make three assumptions regarding the relationship between the quantity of water and the recreation uses of the water: (1) water depth and water velocity are the two streamflow components which are most important in determining whether or not a certain recreation activity may be safely and pleasurably engaged in[1]; (2) there are

[1]Other parameters such as water quality and temperature are also very important in determining the amount of instream recreation use but in many cases are not significantly influenced by flow. Width is also important but is considered outside of the computer model (i.e., width is not a part of the calculation of usable surface area).

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certain measures of water depth and water velocity which may be considered minimum, maximum, and optimum for an activity; and (3) the measurement of water surface area which meets certain requirements of depth and velocity is a viable method of describing recreation potential for instream recreation uses.

This method is comprised of four components: (1) computer simulation of a stream reach, (2) determination of the combinations of stream depth and velocity, (3) determination of a composite probability-of-use for each combination of depth and velocity, and (4) calculation of a weighted usable surface area.

1. Simulation of the Stream. The stream reach simulation model utilized in this approach uses several cross sectional transects, each of which is subdivided into subsections. For any stage (water surface elevation) the mean depth and velocity of each subsection is calculated. Typically, a transect would be established across a pool, a riffle, and an intermediate area. Together these cross sectional measurements would represent a stream reach which may extend several miles. In Table 2 a 100 foot length of stream is represented.

Table 2. Depth velocity matrix showing total surface area of stream in square feet.

Depth (ft)	Velocity in feet per second				
	<0.5	0.5-1.0	1.0-1.5	>1.5	Total
<1	500	400	100	0	1,000
1-2	600	700	800	300	2,400
2-3	100	300	500	100	1,000
>3	0	0	100	0	100
Total	1,200	1,400	1,500	400	4,500

2. Distribution of Combinations of Depth and Velocity. The output of the stream reach simulation model is in the form of a matrix showing the surface area of a stream having different combinations of depth and velocity. Table 2 illustrates a depth velocity matrix. The outlined number in the upper left matrix cell refers to 500 square feet per 100 feet of stream having a combination of depth less than 1.0 foot and velocity less than 0.5 foot per second. This figure is the sum of the areas within the stream reach with this combination of depth and velocity.

In order to evaluate the effect of these physical changes upon a streams desirability for recreation, it is necessary to develop an information base for each recreation activity. Such an information base should identify a relationship between depth and velocity of the water, and the desirability of such water for each recreation activity. The information base, called recreation criteria, has been developed and is set forth in the following pages.

3. Composite Probabilities-of-Use. Determination of the probability-of-use for an activity on a certain area of water requires multiplying the probability-of-use for the depth by the probability-of-use for the velocity. For example, from Figure 1 the probability-of-use for the depth of 2.6 feet is 0.9. The probability-of-use for the velocity of 6 feet per second is 0.24. The composite probability-of-use for a depth of 2.6 feet and a velocity of 6 feet per second, is 0.216 (0.9 x 0.24). The probability-of-use is also the weighting factor for calculation of the weighted usable surface area.

4. Weighted Usable Surface Area. The weighted usable surface area equates an area of low desirability to an equivalent area of optimal desirability. For example, if 1,000 square feet of surface area had a composite probability-of-use of 0.216 (see above) it would have a weighted usable surface area of 216 square feet (total surface area times composite probability-of-use). These 1,000 square feet of surface area would be considered to have the same recreation potential as 216 square feet of surface area having optimum depths and velocities.

An example of a matrix is shown in Table 3. In each cell of the matrix, the upper number refers to the surface area of a stream having a depth velocity combination as indicated. The numbers in parentheses refer to the weighted usable surface area.